Sheet 2

1. The values of N_C and N_V at 300 K for gallium arsenide are $4.7\times10^{17}cm^{-3}$ and $7.0\times10^{18}\ cm^{-3}$, respectively and the bandgap energy is 1.42 eV. Calculate the intrinsic carrier concentration at T = 300 K and at T = 400 K.

2. Calculate the position of the intrinsic Fermi level E_{FI} relative to the mid gap energy in Ge, Si, GaAs at 300K .Use the table and results of problem 6 Sheet 1.

3. Consider an n-type silicon semiconductor at T = 300 K in which $N_d = 10^{16}\ cm^{-3}$ and $N_A = 0$. The intrinsic carrier concentration is assumed to be $n_i = 1.5\ x\ 10^{10}\ cm^{-3}$. Determine the thermal equilibrium electron and hole concentrations for the given doping concentration.

4. Consider a silicon semiconductor at T = 300 K in which $N_A = 10^{16}\ cm^{-3}$ and $N_D = 3\ x\ 10^{15}\ cm^{-3}$.Assume $n_i = 1.5\ x\ 10^{10}\ cm^{-3}$. Calculate the thermal-equilibrium electron and hole concentrations in a compensated p-type semiconductor.

5. In a semiconductor, the Fermi level is 250 meV below the conduction band. What is the probability of finding an electron in a state KT below the valance band edge E_V at room temperature [E_g=1.12ev]?

6. Calculate the intrinsic Fermi energy level with respect to the center of the band gap level at T = 300k of the silicon with $m_h^* = 0.56\ m_0$ and $m_e^* = 1.08\ m_0$.

7. Find the hole concentration in silicon at T=300k, The electron concentration is $n=1\times10^{5}cm^{-3}$ and the intrinsic carrier concentration is $1.5\times10^{10}cm^{-3}$.

8. Prove that the probability of occupying an energy level below the Fermi energy equal the probability that energy level above the Fermi energy and equally far away from the Fermi energy is not occupied.